REMARKS/ARGUMENTS

Upon entry of this Reply, claims 19-45 will remain pending. Claims 19 and 29 are independent claims.

Reconsideration and allowance of the application are respectfully requested.

Claims Pending In The Application

In contrast to the indication on the Cover Sheet of the Final Official Action and in the Final Official Action itself, Applicants note that claims 19-45 are pending in the application. Of these claims, claims 29-41, 44 and 45 are withdrawn from consideration. Therefore, while claims 29-41 are withdrawn from consideration, they are pending claims and should be indicated to be pending claims. Therefore, correction of the record to identify each of the pending claims is respectfully requested.

Response To Maintaining Of Restriction Requirement

Applicants' arguments concerning the restriction requirement have not been addressed in the Final Office Action. However, newly submitted claims 44 and 45 have been indicated to be withdrawn from consideration as being directed to a non-elected invention.

Applicants once again note that the requirement previously confirmed that rejoinder of the non-elected process claims is possible upon allowance of product claims, and if the process claims contain all the limitations or are dependent on the product claims. Therefore, Applicants respectfully request that the Examiner review the process claims, and rejoin them upon allowance of the elected product claims. Moreover, for the reasons set forth below, Applicants respectfully

submit that their invention is patentable over the prior art of record, whereby allowance of all of the pending claim is warranted, and respectfully requested.

Response To Rejections Based Upon Prior Art

The following rejections are set forth in the Office Action:

(a) Claims 19-23, 25-28, 42 and 43 are rejected under 35 U.S.C. 102(b) as being anticipated by, or in the alternative, under 35 U.S.C. 103(a) as obvious over WO 96/30207 to Ravagni et al.

(b) Claim 24 is rejected under 35 U.S.C. under 35 U.S.C. 103(a) as being unpatentable over WO 96/30207 to Ravagni et al. in view of Partlow et al., U.S. Patent No. 5,683,528.

Initially, Applicants once again note that U.S. Patent No. 6,576,182 is a family member of WO 96/30207, and is in the English language. Accordingly, in discussing WO 96/30207, reference will specifically be made to its family member U.S. patent, and these family member documents will collectively be referred to as "the Ravagni documents".

The Examiner is reminded that Applicants' invention, as recited in independent claim 19, is directed to a ceramic multi-layer filter comprising:

at least two layers, said at least two layers comprising the same or different ceramic materials, and a different particle size of ceramic particles in said at least two layers;

one of said at least two layers is a support layer and at least one other layer of said at least two layers is present as a layer with ceramic material with a smaller particle size;

particle surfaces of all ceramic particles in each of said at least two layers, during formation of said at least two layers, are wet entirely or partially with at least one material which wets the surfaces of the ceramic particles and has the same or approximately the same thermal coefficient of expansion as the ceramic particles, and the particle size, particle morphology and particle composition/crystal structure of the ceramic particles is not altered or only slightly altered with about $\leq 1\%$ shrinkage of the ceramic multi-layer filter, and in which at least one of spot and surface connections are formed between the particles; and

pore volume and pore size between the ceramic particles is reduced by the material only slightly or only partially but not by more than 50%.

Thus, amongst other features recited in Applicants' claim 19, the claim includes that particle surfaces of all ceramic particles in each of the at least two layers, during formation of the at least two layers, are wet entirely or partially with at least one material which wets the surfaces of the ceramic particles and has the same or approximately the same thermal coefficient of expansion as the ceramic particles, and the particle size, particle morphology and particle composition/crystal structure of the ceramic particles is not altered or only slightly altered with about $\leq 1\%$ shrinkage of the ceramic multi-layer filter, and in which at least one of spot and surface connections are formed between the particles. Moreover, amongst other features recited in Applicants' claim 19, the claim includes that the pore volume and pore size between the ceramic particles is reduced by the material only slightly or only partially but not by more than 50%.

As disclosed by Applicants in the originally filed application, such as a page 3, beginning at line 12:

> But even slight differences in the shrinkage of multi-layer elements with simultaneous sintering lead to a distortion of the multi-layer element or to internal strains that reduce the mechanical load-bearing capacity. In addition, the shrinkage itself is undesired since it leads to changes in the dimensions of the ceramic formed pieces that are difficult to reproduce and make expensive refinishing steps necessary in order to be able to comply with narrow dimensional tolerances.

In fact, the Examiner is reminded that the disclosure of the Ravagni documents is discussed in the specification. In this regard and as previously noted, WO 96/30207 is discussed and contrasted in the originally filed application in the immediately ensuing paragraphs, wherein it is disclosed that:

> According to WO 96/30207, a process is known in which the shrinkage adaptation of a component of a multi-layer system is achieved by the use of nanoscale powders. In the case of coarsely porous filters, coarse powders are used and the nanoscale powder is added to the mixture to promote its fusion, while, the case of fine powders, the nanoscale powder itself is used and sintering inhibitors are added in order to prevent fusion that is too strong. Agglomerates of the nanoscale powder are also used as coarse powder.
>
> Disadvantageous in the case of this process, however, is the fact that precisely coordinating the shrinkage of the individual components requires relatively expensive experiments, the processing of nanoscale powders is very expensive (for example in the case of dispersion), and the powders are very expensive. In addition, the mixing of powders with different degrees of fineness causes a reduction in the pore volume, which is undesirable for filter applications.
>
> The variations for multi-layer filters cited in the exemplary embodiments mention shrinkages of 5% for the support and 4% for the layer, which leads to great problems in practical application.

Accordingly, it is seen from Applicants' originally filed disclosure that there are disadvantages associated with the structure of the shrinkage matched ceramic composites

disclosed in the Ravagni documents. In particular, such as structure has a reduced pore volume and in the exemplary embodiments has shrinkages of at least 5% for the support and 4% for the layer.

According to the present invention the recited structure includes the feature that the particle size, particle morphology and particle composition/crystal structure of the ceramic particles is not altered or only slightly altered with about ≤ 1% shrinkage of the ceramic multi-layer filter, and in which at least one of spot and surface connections are formed between the particles; and pore volume and pore size between the ceramic particles is reduced by the material only slightly or only partially but not by more than 50%. However, in the Ravagni documents a considerable change of the particle size and/or particle morphology and/or particle composition and/or crystal structure occurs. The amount of pores and the pore size of the shrinkage-matched component in the Ravagni documents are thus also changed considerably. This change is expected in the Ravagni documents by one skilled in the art, because the particles change their form and size through the participation of the ceramic component in the sintering. In contrast, this does not occur in the present invention, because no sinter bridges are formed between the ceramic particles during sintering and so no change in the ceramic particles takes place. The bond between the ceramic particles substantially occurs through the bonds formed through the liquid phase of the wetting material.

Still further, Applicant's claims include that the particle surfaces of all ceramic particles in each of said at least two layers, during formation of said at least two layers, are wet entirely or partially with at least one material which wets the surfaces of the ceramic particles and has the same or approximately the same thermal coefficient of expansion as the ceramic particles. Thus, the at least one material wets the surface of the ceramic particles, and has the same or

approximately the same thermal coefficient of expansion as the ceramic particles. Moreover, the at least one material does not alter or only slightly alters the particle size, particle morphology and particle composition/crystal structure of the ceramic particles with about $\leq 1\%$ shrinkage of the ceramic multi-layer filter, and in which at least one of spot and surface connections are formed between the particles. The Ravagni documents do not disclose such a material and do not teach or suggest a ceramic multi-layer filter having a structure as recited in Applicants' claims.

The rejection asserts that Ravagni discloses "particles wet by wetting material (glass, for example – see specification)"; however, the rejection does not point to any disclosure of Ravagni to support this assertion. In contrast to this assertion, Applicants note that the Ravagni, as disclosed at column 2, lines 29 of the U.S. patent family member, discloses that his invention provides a process for producing composites which comprise at least one shrinkage-matched ceramic component, which process is characterized in that the starting material for the ceramic component(s) whose shrinkage behaviour on sintering is to be matched to the remaining component(s) is selected such that the ceramic-forming constituent of the same consists essentially of: (a) at least one ceramic powder (i) comprising particles having a size of up to 500 nm; (b) at least one ceramic powder (i) as defined in (a) in admixture with at least one powder (ii) comprising at least one sintering-inhibiting substance having a particle size equal to or smaller than that of the powder (i); or (c) at least one ceramic powder (i) as defined in (a) in admixture with at least one ceramic powder (iii) having a particle size above that of the powder (i) used and up to 500 µm.

While Ravagni discloses at column 3, line 55 further components including glass, there apparently no disclosure of glass as a wetting material. The specific characteristic of the powders

i-iv in the first layer of the Ravagni documents is that they are made of ceramic and either differ in grain size or have a sinter-inhibiting effect. Because of this, particles are present in the sintered material either loosely (in the case of the sinter-inhibiting effect) or are fused together, but without being wetted by a second phase. This is unlike the present invention, and cannot yield structure as recited in Applicants' claims. The wetting includes occurrence of a liquid phase during the sintering that does not occur in the Ravagni documents since the ceramic powders used do not melt under the cited sintering conditions. In this regard, it is stated as a particular advantage in the Ravagni documents that the powders for the first layer are made of the same (ceramic) material, and consequently differ only in their grain size or the state of agglomeration. Consequently, the entire layer would melt when the melting point of a component was reached and thus would not result in the desired properties of the composite.

Thus, the Ravagni documents do not teach or suggest particle surfaces of all ceramic particles in each of the at least two layers, during formation of the at least two layers, are wet entirely or partially with at least one material which wets the surfaces of the ceramic particles and has the same or approximately the same thermal coefficient of expansion as the ceramic particles, and the particle size, particle morphology and particle composition/crystal structure of the ceramic particles is not altered or only slightly altered with about $\leq 1\%$ shrinkage of the ceramic multi-layer filter, and in which at least one of spot and surface connections are formed between the particles. This structure is associated with Applicants' ceramic multi-layer filter, and the rejection cannot ignore these structural differences. Inherency is not present because, in contrast to the assertions in the rejection, the materials are not the same or similar as asserted in the rejection. Applicants'

claims include structure that is not taught or suggested in the prior art of record.

Applicants note that their arguments are not only directed to process conditions, but to differences in structure associated with Applicants' ceramic multi-layer filter, and these structural differences are not taught nor suggested in the prior art of record.

The Examiner's attention is once again directed to the Examples of Ravagni which include embodiments which show a different structure than that recited by Applicants.

Example 1 of the Ravagni documents is directed to a composite of a dense ZrO_2 layer (sheet B) on a porous ZrO_2 substrate (sheet A). This should not be considered to be a multi-layer filter, because of the dense layer. Moreover, before sintering sheets A and B contain ZrO_2 particles of 10 nm. During sintering at 1150°C for 2h both sheets are subjected to a linear shrinkage of 40% and one of the sheets is densely sintered. Moreover, such high shrinkage should lead to a considerable change of the 10 nm particles and it will be possible to detect changes in form and size of the particles in the structure.

A two-layer structure is described in Examples 3 – 5, the sheets in these examples are sintered together at 1500°C for 2h, and it is disclosed that there is a linear shrinkage of 5% (sheet A) and 4% (sheet B). The differences between 5 and 4% are considerable for sintering a layer composite and would lead to stresses or distortion of the laminate. With a length of foil of 100 mm, this would be a1mm difference in length. It does not appear that a shrinkage of 4-5% is sufficient to achieve dense layers whereby the two layers may be porous. However, at a sinter temperature of 1500°C at least the fine corundum powder (200 or 400 nm) will be greatly changed in both layers with regard to form and size, since otherwise no sintering of the particles would occur and

after sintering the material would disintegrate into its powder components. One skilled in the art would also expect powders of this fineness to be considerably changed regarding size and grain form during sintering at the given temperatures.

In Example 6, sintering is performed at 1550°C and leads to a shrinkage of 30% and to a dense layer B, so that here an analogous great change of the grain size, the pore size and the pore volume as in Examples 1-2 is to be assumed. Also, a change in crystal structure would be expected under these sintering conditions with the gamma Al_2O_3 being transformed into the alpha phase.

Still further, the Examiner is once again reminded that in order for inherency to be present the Examiner has the burden of showing that the result indicated by the Examiner is the necessary result, and not merely a possible result. In re Oelrich, 212 U.S.P.Q. 323 (CCPA 1981); Ex parte Keith et al., 154 U.S.P.Q. 320 (POBA 1966). The fact that a prior art article may inherently have the characteristics of the claimed product is not sufficient. Ex parte Skinner, 2 U.S.P.Q.2d 1788 (BPAI 1986).

As the Board of Patent Appeals and Interferences states in Ex parte Levy, 17 U.S.P.Q.2d 1461, 1463:

> However, the initial burden of establishing a prima facie basis to deny patentability to a claimed invention rests upon the examiner. In re Piasecki, 745 F.2d 1468, 223 USPQ 785 (Fed. Cir. 1984). In relying upon the theory of inherency, the examiner must provide a basis in fact and/or technical reasoning to reasonably support the determination that the allegedly inherent characteristic necessarily flows from the teachings of the applied prior art. In re King, 801 F.2d 1324, 231 USPQ 136 (Fed. Cir. 1986); W.L. Gore & Associates, Inc. v. Garlock, Inc., 721 F.2d 1540, 220 USPQ 303 (Fed. Cir. 1983); In re Oelrich, 666 F.2d 578, 212 USPQ 323 (CCPA 1981); In re Wilding, 535 F.2d 631, 190 USPQ 59 (CCPA 1976); Hansgirg v. Kemmer, 102

> F.2d 212, 40 USPQ 665 (CCPA 1939).in order for inherency to be present it must be a necessary result, and not merely a possible results. Ex parte Keith and Turnquest, 154 U.S.P.Q. 320 (B.O.A. 1966).

In the instant situation, it is seen that the Ravagni documents do not teach the ceramic multi-layer structure recited in Applicant's claims, and the prior art does not teach or suggest any modification of the Ravagni documents to arrive at Applicant's disclosed and claimed invention, and the advantages associated therewith.

Applicants' once again note that Partlow does not overcome the deficiencies of the Ravagni documents. In this regard, Partlow is utilized in the rejection merely for its disclosure of borosilicate glass in ceramic layers. Accordingly, whether or not Partlow would motivate one having ordinary skill in the art to include borosilicate glass in the Ravagni documents, Applicants disclosed and claimed invention would not be present.

Still further, Partlow discloses the production of a special borosilicate glass that is used to produce electronic packages. The term "multi-layer" is here used for the powder, i.e., a method is described of how spherical SiO_2 powder with a surface containing B_2O_3 can be enveloped in a multi-layer manner. This powder is used as an active component for producing foils for electronic packages. In the sintering of the packages at any rate a highly dense product is aimed for; i.e., the borosilicate glass powder is used as active component for dense sintering (column 4, lines 45-47 or claim 1d), primarily because through its fluxing effect it can cause a densification at temperatures below 1000°C. It is sintered alone (in the example) or together with a ceramic filler material, preferably quartz powder. In any case, however, the borosilicate glass powder will form the matrix of the material (claim 1d), i.e., the greatest proportion of the volume, whereas the

ceramic powder is added only as a component of smaller amount. The purpose of the filler material here is to match the coefficient of expansion of the sintered (dense) material to that of the semiconductor materials (e.g. GaAs, column 3, beginning at line 66) mounted on the packages.

Since before sintering the powder has porosity in the green body, but during sintering it is sintered into a dense product, it would appear that during sintering a 100% reduction of the pore volume occurs through the use of the specially produced multi-layer borosilicate glass powder.

Thus, one having ordinary skill in the art would not have been motivated to combine the documents in the manner asserted in the rejection, and even if combined would not arrive at Applicant's disclosed and claimed invention.

Still further, Applicants' dependent claims further patentably define Applicants' inventions. Thus, claim 20 further patentably defines that when more than two layers are present on the support layer, the particle size of the ceramic particles decreases in a direction going away from the support.

Claim 21 further patentably defines that the at least two layers comprise layers of the same ceramic material.

Claim 22 further patentably defines that the ceramic material is silicon carbide or aluminum oxide.

Claim 23 further patentably defines that the ceramic material in all layers of the filter and the material which wets the surfaces of the ceramic particles, have a same composition in all layers of the filter.

Claim 24 further patentably defines that the material that wets the surfaces of the ceramic particles and forms the at least one of spot and surface connection between the ceramic particles is a borosilicate glass, an aluminum borosilicate glass or a lithium aluminum silicate glass. As discussed above, the Ravagni documents do not teach or suggest such a glass material.

Claim 25 further patentably defines that the quantity of material, which wets the surface of the ceramic particles and forms the at least one spot and surface connection between the ceramic particles, is selected in terms of size in such a way that the pore volume and the pore size between the particles is reduced only slightly by the material.

Claim 26 further patentably defines that the quantity of material, which wets the surface of the ceramic particles and forms the at least one spot and surface connection between the ceramic particles, is selected in terms of size in such a way that the pore volume and the pore size between the particles is reduced by not more than 10%.

Claim 27 further patentably defines that the ceramic particles of at least two layers differentiate from one another in a ratio of 1 : 5 to 1 : 10 in terms of their average particle size.

Claim 28 further patentably defines that the particles of the support layer have an average particle size of 20 to 50 μm.

In view of the above, the rejections of record should be withdrawn, and all of the pending claims indicated to be allowable. In the event that the rejection is maintained, the Examiner is respectfully requested to specifically point out structural similarities between Applicants' disclosed and claimed invention with respect to the prior art when the prior art is different from Applicants' invention in the diverse instances noted above.

CONCLUSION

In view of the foregoing, the Examiner is respectfully requested to reconsider and withdraw the rejections of record, and allow each of the pending claims.

Applicants therefore respectfully request that an early indication of allowance of the application be indicated by the mailing of the Notices of Allowance and Allowability.

Should the Examiner have any questions regarding this application, the Examiner is invited to contact the undersigned at the below-listed telephone number.

Respectfully submitted,
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